CHEMISTRY DEPARTMENT

FACULTY

Geneive Elizabeth Henry, Ph.D., Professor of Chemistry, department head
Swarna Basu, Ph.D., Professor of Chemistry
Wade Johnson, Ph.D., Professor of Chemistry
William G. Dougherty, Jr, Ph.D., Associate Professor of Chemistry
Lou Ann Tom, Ph.D., Associate Professor of Chemistry
Michael A. Parra, Ph.D., Assistant Professor of Chemistry
Phillip Brogdon, Ph.D., Assistant Professor of Chemistry
Khushikumari Patel, Ph.D., Postdoctoral Teaching Fellow in Chemistry

LEARNING GOALS:

- Demonstrate the ability to apply appropriate chemical and physical models to make predictions or draw conclusions regarding chemical systems or phenomenon. Examples of chemical systems are compound formation (synthesis), energy transfer, equilibrium composition, various physical properties, chemical reactivity, etc.
- Demonstrate mastery of laboratory skills and execute common experimental techniques.
- Demonstrate the ability to design, prepare, execute and adjust experiments.
- Describe the theoretical and operational principles of common laboratory instrumentation such as NMR, FT- IR, UV-Vis, AA, fluorescence spectrometers, GC-MS, HPLC and electrochemical analysis instrumentation, as well as their typical uses, sensitivities and limitations. Interpret the data collected with such instrumentation.
- Find topic-specific chemical literature, interpret and evaluate chemical studies as described in scientific journals, and describe these conclusions through written and oral presentations.
- Analyze and interpret data to detect trends, evaluate the quality of data and reach scientifically valid conclusions.

American Chemical Society Accreditation. The department's major in chemistry is accredited by the American Chemical Society.

Requirements for the Majors in Chemistry, Biochemistry and Chemical Physics. Susquehanna offers a Bachelor of Arts degree in chemistry and Bachelor of Science degrees in chemistry, biochemistry and chemical physics. Two biochemistry tracks are available: an ACS-Certified track and a Biology-Intensive track. The ACS-Certified track includes courses that cover properties of metals, spectroscopic techniques and instrumental methods that will prepare students for careers or graduate programs in the areas of biochemistry or biophysics. The Biology-Intensive track includes courses that will offer a solid foundation in chemical principles in addition to biological systems and will prepare students for careers or graduate programs in the biological sciences or biochemistry, or the health care professions.

Double-counting restriction: students pursuing a chemistry or biochemistry major in the chemistry department may double-count a maximum of 16 semester hours toward another major or minor.

CHEMISTRY

The Bachelor of Arts degree in chemistry requires the following courses, with grades of C- or better:

4	General Chemistry I - choose from: CHEM-101, CHEM-103 or CHEM-111
4	General Chemistry II - choose from: CHEM-102, CHEM-104 or CHEM-232
4	CHEM-221 Organic Chemistry I
4	CHEM-222 Organic Chemistry II
4	CHEM-242 Methods of Chemical Analysis
4	CHEM-341 Physical Chemistry I

4	CHEM-342 Physical Chemistry II
4	CHEM-450 Advanced Inorganic Chemistry
4	PHYS-203 or PHYS-204 Introductory Physics I (Calculus-based)
4	PHYS-206 Introductory Physics II (Calculus-based)
4	Four semester equivalents of CHEM-505 Seminar
0-8	Mathematics through MATH-112 Calculus II
2	CHEM-400 Research Experience
2	CHEM-500 Problems in Chemistry and Biochemistry

Other chemistry courses selected to fulfill career goals.

The Bachelor of Science degree in chemistry with American Chemical Society certification requires a minimum of 49 semester hours in chemistry. Students will meet the requirements for the degree by completing the following courses: all courses required for the Bachelor of Arts degree; CHEM-430 Instrumental Analysis, one biochemistry course from among CHEM-422 The Biochemistry of Nucleic Acids, CHEM-424 The Biochemistry of Metabolism or CHEM-426 The Biochemistry of Proteins and Enzymes; and one elective course from among CHEM-300 Topics in Chemistry, CHEM-302 Medicinal Chemistry, CHEM-303 Scientific Ethics, Blunders, and Fraud, CHEM-304 Pharmaceutical Chemistry, CHEM-305 Forensic Chemistry or CHEM-306 Nanoscience. In addition, students will complete a minimum of four semester hours of CHEM-400 during the junior and/or senior year (including the two semester hours required for the Bachelor of Arts degree) and either MATH-201 Linear Algebra or MATH-353 Differential Equations. All required courses must be completed with a grade of C- or higher.

A student completing a double major that includes a Bachelor of Arts or Bachelor of Science degree in Chemistry may replace CHEM-500 with a capstone in the second major.

Secondary Teaching Certification. The Chemistry Department offers secondary teaching certification for both chemistry and biochemistry majors.

Coursework required by the state of Pennsylvania for admission to the teacher certification program includes successful completion of ENGL-100 Writing and Thinking or equivalent course, at least 3 semester hours in British or American literature, at least 6 semester hours of mathematics coursework (or other courses which satisfy the Central Curriculum Analytical Thought requirement), and at least one 40-hour externship. Education course requirements for secondary education are EDUC-101 Introduction to Education and Society, EDUC-102 Historical and Philosophical Foundations of Education, EDUC-250 Educational Psychology, EDUC-260 Introduction to Special Education, EDUC-270 Instruction of Exceptional Students, EDUC-330 Technology in Education, EDUC-350 English Language Learners: Theory and Instruction, EDUC-380 Instructional Design, EDUC-424 Methods of Curriculum, Instruction, and Assessment in Teaching Science, EDUC-479 Principles of Learning and Teaching in Secondary Education, EDUC-483 Differentiated Instruction and Classroom Management in Secondary Education, and the EDUC-500 Student Teaching Package (EDUC-501, EDUC-502, EDUC-503, and EDUC-600).

In addition, secondary education chemistry students complete all of the usual requirements for the chemistry or biochemistry major, except for CHEM-400, and CHEM-500 (which is fulfilled with EDUC-500 Student Teaching Package.) While not required, it is recommended that secondary education students complete at least 2 semester hours of CHEM-400.

BIOCHEMISTRY

The Bachelor of Science degree in biochemistry requires the following courses with grades of C- or better:

4	General Chemistry I - choose from: CHEM-101, CHEM-103 or CHEM-111
4	General Chemistry II - choose from: CHEM-102, CHEM-104 or CHEM-232
4	CHEM-221 Organic Chemistry I
4	CHEM-222 Organic Chemistry II
4	CHEM-242 Methods of Chemical Analysis
4	CHEM-341 Physical Chemistry I
4	CHEM-426 The Biochemistry of Proteins and Enzymes and CHEM-427 Biochemistry of Proteins and Enzymes Laboratory

4	CHEM-422 The Biochemistry of Nucleic Acid and CHEM-423 The Biochemistry of Nucleic Acid Lab or CHEM-424 The Biochemistry of Metabolism and CHEM-429 Biochemistry of Metabolism Lab
4	Four semester equivalents of CHEM-505 Seminar
4	Introductory Physics I: Calculus (Choose from: PHYS-203 or PHYS-204)
4	Introductory Physics II: Calculus (PHYS-206)
4	BIOL-102 Cell Biology and Genetics
4	CHEM-400 Research Experience
2	CHEM-500 Problems in Chemistry and Biochemistry
0-8	Mathematics through MATH-112 Calculus II

In addition to the courses outlined above, students will complete one of the following two options.

Biology Intensive Track

12	12 semester hours of biology course beyond BIOL-102, at least 8 of which must be at or above the 300 level (excluding BIOL-501 and BIOL-510)

ACS-Certified Track

4	4 semester hours of biology courses beyond BIOL-102, at or above the 300 level (excluding BIOL-501 and BIOL-510)
4	CHEM-450 Advanced Inorganic Chemistry
4	CHEM-342 Physical Chemistry II or CHEM-430 Instrumental Analysis

A student completing a double-major that includes a B.S. in Biochemistry may replace CHEM-500 with a capstone in the second major.

CHEMICAL PHYSICS

Double-counting restriction: students majoring in chemical physics cannot double-count courses towards a chemistry or physics major.

The Bachelor of Science degree in chemical physics requires the following courses with grades of C- or better:

4	General Chemistry I (Choose from: CHEM-101, CHEM-103 or CHEM-111)
4-8	General Chemistry II (Choose from: CHEM-102, CHEM-104) or Structure and Reactivity (CHEM-232) together with Methods of Chemical Analysis (CHEM-242)
4	Introductory Physics I: Calculus (Choose from: PHYS-203 or PHYS-204)
4	Introductory Physics II: Calculus (PHYS-206)
4	CHEM-221 Organic Chemistry I
4	CHEM-341 Physical Chemistry I
4	CHEM-342 Physical Chemistry II
4	PHYS-404 Thermodynamics and Statistical Methods
4	MATH-111 Calculus I
4	MATH-112 Calculus II
4	MATH-201 Linear Algebra
2	Capstone, chosen from CHEM-500 Problems in Chemistry and Biochemistry, or PHYS-550 Physics Research. Students much complete at least 2 SH of CHEM-400 Research Experience prior to taking CHEM-500.

Other requirements: Students must select at least four courses from the following list, with at least one course from each department and no more than two courses from a single department. Students may take additional courses as long as the total number of semester hours in the major does not exceed 64.

Chemistry
CHEM-306 Nanoscience
CHEM-430 Instrumental Analysis

Mathematics
MATH-211 Multivariate Calculus
MATH-353 Differential Equations

Physics
PHYS-101 Introduction to Digital and Analog Electronics
PHYS-105 Independent Thought and Exploration in Physics
PHYS-306 Modern Physics

Honors in Chemistry. The departmental honors program encourages and recognizes superior performance in chemistry. To graduate with honors in chemistry, candidates must do the following:

- Maintain at least a 3.25 cumulative GPA overall and a 3.50 cumulative GPA in chemistry courses (plus biology courses for biochemistry majors),
- Petition the research advisor in writing by the third week of their final semester. The research advisor will make a request on behalf of the honors candidate to the department chair.
- Upon departmental approval, submit an acceptable written thesis based on a minimum of 4 semester hours of CHEM-400, completed during the junior and/or senior years, and CHEM-500 (or BIOL-510 and BIOL-511, if approved by Chemistry Department), and
- Pass an oral thesis defense.

Minor in Chemistry. Students minoring in chemistry complete five courses: General Chemistry I (CHEM-101, CHEM- 103 or CHEM-111) and General Chemistry II (CHEM-102, CHEM-104), or Structure and Reactivity (CHEM-232), CHEM-221 Organic Chemistry I, and one of the following courses: Analytic Chemistry (CHEM-311), Physical Chemistry (CHEM-341), Topics in Chemistry (CHEM-300), Medicinal Chemistry (CHEM-302), Scientific Ethics, Blunders, and Fraud (CHEM-303), Pharmaceutical Chemistry (CHEM-304), Forensic Chemistry (CHEM-305), or Nanoscience (CHEM-306). Methods of Chemical Analysis (CHEM-242) may be used to fulfill the minor requirement, but is only recommended if a student completes Structure and Reactivity instead of General Chemistry II.

Minor in Biochemistry. Students minoring in biochemistry complete General Chemistry I (CHEM-101, CHEM-103 or CHEM-111) and General Chemistry II (CHEM-102, CHEM-104 or CHEM-232), the Organic Chemistry I-II sequence (CHEM-221-222), The Biochemistry of Proteins and Enzymes lecture and lab (CHEM-426 and CHEM-427), and either CHEM-422 The Biochemistry of Nucleic Acids or CHEM-424 The Biochemistry of Metabolism.

CHEMISTRY COURSES

CHEM-100 Trends in Chemistry

Emphasizes the use of chemistry by society and in nature. This course presents the basic chemical concepts in a variety of contexts. Subjects might include environmentally friendly green chemistry, medicinal, nanotechnology, chemistry of movies and magic, or chemistry of everyday objects. Students who have completed General Chemistry I (CHEM-101, CHEM-103 or CHEM-111) may not enroll in CHEM-100. 4 SH. 3 lecture hours, 3 laboratory hours. CC: Scientific Explanations.

CHEM-101 General Chemistry I

Fundamental laws and principles, atomic structure and periodicity, bonding, molecular structure, stoichiometry, chemical reactions, energy, equilibrium, thermodynamics and nuclear chemistry. Students may receive credit for only one of the three introductory chemistry I courses, CHEM-101, CHEM-103, or CHEM-111. 4 SH. 3 lecture hours, 3 laboratory hours (taken as CHEM-105, not a separate credit/grade). CC: Scientific Explanations.

CHEM-102 General Chemistry II

Properties of gases, liquids, solids and solutions, kinetics, acids, bases, buffers, solubility, complex ion equilibria, electrochemistry, and descriptive and coordination chemistry. Students may receive credit for only one of the three introductory chemistry II courses, CHEM-102, CHEM-104, or CHEM-232. Prerequisite: CHEM-101, CHEM-103 or CHEM-111. 4 SH. 3 lecture hours, 3 laboratory hours (taken as CHEM-106, not a separate credit/grade).

CHEM-103 General Chemistry I: Teams

Fundamental laws and principles, atomic structure and periodicity, bonding, molecular structure, stoichiometry, chemical reactions, energy, equilibrium, thermodynamics and nuclear chemistry. Students may receive credit for only one of the three introductory chemistry I courses, CHEM-101, CHEM-103, or CHEM-111. 4 SH. 3 lecture hours, 3 laboratory hours (taken as CHEM-105, not a separate credit/grade). CC: Scientific Explanations.

CHEM-104 General Chemistry II: Teams

Properties of gases, liquids, solids and solutions, kinetics, acids, bases, buffers, solubility, complex ion equilibria, electrochemistry, and descriptive and coordination chemistry taught in a team-based format. Students may receive credit for only one of the three introductory chemistry II courses: CHEM-102, CHEM-104 or CHEM-232. Prerequisite: CHEM-101, CHEM-103 or CHEM-111. 4 SH. 3 lecture hours, 3 laboratory hours (taken as CHEM-106, not a separate credit/grade).

CHEM-111 General Chemistry I: Teams WS

Fundamental laws and principles, atomic structure and periodicity, bonding, molecular structure, stoichiometry, chemical reactions, energy, equilibrium, thermodynamics and nuclear chemistry taught in a team-based workshop format, with the lab and lecture integrated. Students may receive credit for only one of the three introductory chemistry I courses, CHEM-101, CHEM-103, or CHEM-111. 4 SH. 3 lecture hours, 3 laboratory hours. CC: Scientific Explanations.

CHEM-200 Research Exploration

Individual or team investigation of a novel problem in chemistry or biochemistry in collaboration with a faculty member. Introduction to common methods and techniques used in the chemistry and biochemistry fields. This course may only be taken in the first and/or second year of the Chemistry/Biochemistry/Chemical Physics program and can be repeated for credit. Prerequisite: Instructor's permission. 1-4 SH.

CHEM-221 Organic Chemistry I

Basic concepts of stereochemistry and chemistry of aliphatic hydrocarbons, alkyl halides and alcohols. Prerequisite: CHEM-101, CHEM-103 or CHEM-111. 4 SH. 3 lecture hours, 3 laboratory hours (taken as CHEM 221L, not a separate credit/grade).

CHEM-222 Organic Chemistry II

Basic concepts of spectroscopy, and chemistry of aromatic hydrocarbons, conjugated alkenes, amines, ethers, carbonyl compounds, carboxylic acid derivatives, and carbohydrate building blocks. Prerequisite: CHEM-221. 4 SH. 3 lecture hours, 3 laboratory hours (taken as CHEM 222L, not a separate credit/grade). CC: Writing Intensive.

CHEM-232 Structure and Reactivity

Structure and reactivity of solids, liquids, gases, and solutions will be investigated. Molecular symmetry, molecular orbital theory and chemical kinetics will be introduced. Basic coordination chemistry will be discussed; including molecular and electronic structure, acid/base theory, magnetism, and common ligands. Students may receive credit for only one of the three introductory chemistry II courses: CHEM-102, CHEM-104 or CHEM-232. Prerequisite: CHEM-222 (Organic Chemistry II). Restricted to Chemistry, Biochemistry and Chemical Physics majors. 4 SH. 3 lecture hours, 3 laboratory hours.

CHEM-242 Methods of Chemical Analysis

Classical and modern analytical methods for quantitative determination of chemical species. Analytical processes, measurements, instrumentation, error, and statistics are discussed. Topics include theory and laboratory techniques of potentiometry, optical spectroscopy, chromatography, and mass spectrometry. Prerequisites: CHEM-101, -103 or -111. 4 SH. 3 lecture hours. 3 laboratory hours.

CHEM-300 Topics in Chemistry

Varied topics reflecting student and instructor interests. Possibilities include organometallic chemistry, environmental chemistry, green chemistry, proteomics and chemistry of art. Prerequisite: CHEM-222 (may be others for some topics). 1-4 SH. Offered as lecture only, laboratory only, or as a lecture/laboratory combination.

CHEM-302 Medicinal Chemistry

This course integrates principles from the disciplines of chemistry, biology and pharmacology to study the discovery, design and mechanisms of action of important anticancer, antiviral, antibacterial, cardioprotective and antidepressant drugs. Major emphasis is placed on drug interactions with nucleic acids, enzymes and receptors. Prerequisites: Junior standing and CHEM-222. 4 SH. Offered as lecture only. CC: Interdisciplinary.

CHEM-303 Scientific Ethics, Blunders, and Fraud

Examines the science and the scientific method through the lens of ethics to distinguish scientific error from outright fraud. The course looks at classic and contemporary scientific blunders and fraud cases in academia, industry and government. Examines ethical policy from the fallout of academic fraud. Prerequisite: Sophomore standing and CHEM-222. 4 SH. CC: Ethics Intensive, Interdisciplinary.

CHEM-304 Pharmaceutical Chemistry

In this course students will learn about partition coefficient and biopharmacy, physicochemical properties of drugs, stereochemistry, drug metabolism, volumetric analysis of drugs, analytical spectroscopy, stability of drugs and medicines, kinetics of drug stability, licensing of drugs and the British Pharmacopoeia, method validation, and GMPs. Prerequisite: Junior standing and CHEM-222. 4 SH. 4 lecture hour (may be taught 3 lecture hours, 3 laboratory hours). CC: Interdisciplinary.

CHEM-305 Forensic Chemistry

This course approaches the challenges, methods, analyses and ethics of forensic chemistry from fundamental chemical and biological perspectives, including quality assurance, sampling and evidence collection and preservation, instrumentation, drugs as physical evidence, analysis of seized drugs, drugs in the body, forensic toxicology, combustion and arson, explosives, firearms, colorants, polymers, paper and fibers, and forensic DNA analysis. Students will also be able to articulate the basic ethical questions and issues related to the study of forensics. Prerequisite: Junior standing and CHEM-222. 4 SH. 4 lecture hours (may be taught 3 lecture hours, 3 laboratory hours). CC: Ethics Intensive, Interdisciplinary.

CHEM-306 Nanoscience

An introduction to many aspects of nanoscience and nanotechnology. Interdisciplinary connections between chemistry, physics, biology and material science are investigated through readings, discussions and laboratory experiments. Major topics include the formation and implementation of nano-structured systems, synthesis, and detection of nanoparticles, their current roles in technology, medical applications, ethical implications, and the likely future impact of such systems on society, industry and the environment. Prerequisite: Sophomore standing and CHEM-222. 4 SH. CC: Interdisciplinary.

CHEM-311 Analytical Chemistry

Chemical species are analyzed by classical quantitative and modern spectrometric methods. Theory of equilibrium, potentiometric, optical, chromatographic and mass spectral techniques are discussed. Laboratories range from volumetric, gravimetric and potentiometric wet techniques to photospectrometric methods (Uv-vis, FT-IR, AA) and mass spectrometry. This class is specifically designed for the chemistry minor and does not count toward the chemistry major, the biochemistry major or as an elective. Prerequisites: CHEM-101-102, CHEM-103-104 or CHEM- 111-112. 4 SH. 3 lecture hours, 3 laboratory hours.

CHEM-314 Survey of Biochemistry

A survey of Biochemistry: structure and function of amino acids, proteins, lipids, carbohydrates, and nucleic acids; enzymology; metabolism; biosynthesis; and selected topics. Not acceptable for credit toward a major in Chemistry or Biochemistry, nor Biochemistry minor. Prerequisite: CHEM-102 General Chemistry II, CHEM-104 General Chemistry II: Teams or CHEM-232 Structure and Reactivity and CHEM-222 Organic Chemistry II. 4 SH.

CHEM-341 Physical Chemistry I

An in-depth study of classical and statistical thermodynamics and reaction kinetics presented with applications to phase equilibria, chemical equilibria, solute-solvent interactions and nonequilibrium thermodynamics. Prerequisites: CHEM-242, MATH-112, and PHYS-206 (Calculus-based) or instructor's permission. 4 SH. 3 lecture hours, 3 laboratory hours. CC: Writing Intensive.

CHEM-342 Physical Chemistry II

Introduction to quantum chemistry and spectroscopy. Theory of quantum mechanics presented at a fundamental level with special attention paid to classical problems—particle in a box, harmonic oscillator, rigid rotor and hydrogen atom—and practical application to the electronic structure of atoms and molecules and to atomic and molecular spectroscopy. Prerequisites:CHEM-242, MATH-112 and PHYS-206 (Calculus-based) or instructor's permission. 4 SH. 3 lecture hours, 3 laboratory hours.

CHEM-400 Research Experience

Individual investigation of a novel problem in chemistry or biochemistry in collaboration with a faculty member. Introduction to common methods and techniques used in the chemistry and biochemistry fields. May be repeated for credit. Prerequisite: Instructor's permission. 1-4 SH.

CHEM-422 The Biochemistry of Nucleic Acids

This course integrates information from the disciplines of biology and chemistry to explore nucleic acid function and metabolism. In-depth discussions cover the forces behind DNA/DNA, DNA/RNA and DNA/protein interactions as they apply to DNA structure and metabolism, RNA function and metabolism, protein synthesis, and gene regulation. Prerequisite: CHEM-102 General Chemistry II, CHEM-104 General Chemistry II: Teams or CHEM-232 Structure and Reactivity and CHEM-222 Organic Chemistry II. Strongly recommended: BIOL-426/CHEM-426. 3 SH. 3 lecture hours.

CHEM-423 Biochemistry Nucleic Acids Laboratory

Exploration of nucleic acids, including methods of isolation, purification, identification and analysis. Prerequisite: CHEM-102 General Chemistry II, CHEM-104 General Chemistry II: Teams or CHEM-232 Structure and Reactivity and CHEM-222 Organic Chemistry II. 1 SH. 3 laboratory hours.

CHEM-424 The Biochemistry of Metabolism

This course covers the structure and function of major biomolecules such as carbohydrates and lipids and their role in metabolism. Energy metabolism and biomolecule biosynthesis and degradation are emphasized. Prerequisite: CHEM-102 General Chemistry II, CHEM-104 General Chemistry II: Teams or CHEM-232 Structure and Reactivity and CHEM-222 Organic Chemistry II. Strongly recommended: BIOL-426/CHEM-426. 3 SH. 3 lecture hours.

CHEM-426 The Biochemistry of Proteins and Enzymes

This course focuses on the structure of proteins, the thermodynamics of protein folding, enzyme catalytic mechanisms and enzyme kinetics. This course also introduces the field of bioinformatics, the use of computer databases to determine relationships between nucleic acid sequence, protein structure and protein function. Prerequisite: CHEM-102 General Chemistry II, CHEM-104 General Chemistry II: Teams or CHEM-232 Structure and Reactivity and CHEM-222 Organic Chemistry II. 3 SH. 3 lecture hours.

CHEM-427 Biochemistry of Proteins and Enzymes Laboratory

This lab explores enzyme kinetics and inhibition, as well as methods of isolation, purification, identification and analysis of proteins and enzymes. This lab is designed to provide technical skills necessary for biochemical research. Prerequisite: CHEM-102 General Chemistry II, CHEM-104 General Chemistry II: Teams or CHEM-232 Structure and Reactivity and CHEM-222 Organic Chemistry II. 1 SH. 3 laboratory hours.

CHEM-429 Biochemistry of Metabolism Laboratory

This lab explores metabolic function and metabolites. The lab focuses on the isolation, purification, identification and analysis of metabolites. Prerequisite: CHEM-102 General Chemistry II, CHEM-104 General Chemistry II: Teams or CHEM-232 Structure and Reactivity and CHEM-222 Organic Chemistry II. 1 SH. 3 laboratory hours.

CHEM-430 Instrumental Analysis

Instrumental techniques of analysis, focuses on atomic and molecular spectroscopy, including chemical principles behind the instrumental techniques, instrument operation, and applications of instrumental analysis. Some discussion of macromolecule (polymer) analysis will also be included. Prerequisite: CHEM-342 or instructor's permission. 4 SH. 3 lecture hours, 3 laboratory hours.

CHEM-450 Advanced Inorganic Chemistry

Inorganic atomic structure and bonding, coordination compounds, acid-base theory and selected inorganic systems. Prerequisite: CHEM-342. 4 SH. 3 lecture hours, 3 laboratory hours.

CHEM-490 Chemistry Independent Study

Individual work for qualified students under the direction of a faculty member. Usually deals with specialized topics not covered in regularly offered courses. Prerequisites: Instructor and department head approval. 2-4 SH.

CHEM-500 Problems in Chemistry and Biochemistry

Individual study of a problem in experimental chemistry under the direction of a faculty member, and public presentation of the results. May not be repeated for credit. Co-/Prerequisite: Senior standing and completion of a minimum of 2 semester hours in CHEM-400 during the junior and/or senior year. 2 SH. Capstone.

CHEM-501 Independent Study

Investigation of a specific topic or problem under the guidance of an appropriate faculty member. 1-4 SH. CHEM-505 Seminar

Weekly meetings in which students report on current chemical research literature. Researchers from other institutions and industry will also be invited to present their research. Four semester hours in a manner approved by the student's adviser are required for all majors. Prerequisite: Junior standing. Variable credit. CC: Oral Intensive.

CHEM-505 Seminar

Weekly meetings in which students report on current chemical research literature. Researchers from other institutions and industry will also be invited to present their research. Four semester hours in a manner approved by the student's adviser are required for all majors. Prerequisite: Junior standing. 1-4 SH.

CHEM-590 Chemistry Internship

Selected students work in the chemical industry under the supervision of an industrial chemist. Prerequisites: CHEM-242 and department head's permission. 4 SH. S/U grade.